(45)

$f(x) = 6x^2$

$f(x+h) = 6(x+h)^2$

$= 6(x^2 + 2xh + h)$

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\lim_{h \to 0} \frac{6\left[x^2 + 2xh + h^2 - x^2\right]}{h} \Rightarrow \frac{6\left[2xh + h^2\right]}{h}$$

$$\lim_{h \to 0} 12x + 6h = 12x \text{ at } x = a \rightarrow \boxed{12a}$$

47

$f(x) = x^2 - 3x$

$P = (1, f(1))$

$P = (1, -2)$

$m = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$f(x+h) = (x+h)^2 - 3(x+h)$

$= x^2 + 2xh + h^2 - 3x - 3h$

$\lim_{h \to 0} \frac{x^2 + 2xh + h^2 - 3x - 3h - x^2 + 3x}{h}$

$\lim_{h \to 0} 2x + h - 3 = 2x - 3 = \text{slope}$

Slope at $(1,-2)$ $2(1) - 3 = -1$

tangent $y = m(x - x_1) + y_1$

$y = -1(x-1) - 2$

Normal line $y = (x-1) - 2$

#5

$$\lim_{x\to 0} \frac{\frac{1}{2+x} - \frac{1}{2}}{x}$$

$$\frac{2}{2}\cdot\frac{1}{2+x} - \frac{1}{2}\cdot\frac{2+x}{2+x}$$

$$\lim_{x\to 0} \frac{\frac{-x}{4+2x}}{x}$$

$$\frac{2-(2+x)}{2(2+x)} = \frac{-x}{4+2x} = \text{top}$$

$$\lim_{x\to 0} \frac{-x}{4+2x}\cdot\frac{1}{x} = \frac{-1}{4+2x} = \boxed{-\frac{1}{4}}$$

$$\lim_{x\to\infty} \frac{x+\sin x}{x+\cos x} = 1$$

$$\frac{x-1}{x+1} \le \frac{x+\sin x}{x+\cos x} \le \frac{x+1}{x-1}$$

$$\downarrow \qquad\qquad \downarrow$$

$$1 \le \quad ? \quad \le 1$$

(39) Given

$r = 12.96$ cm

$t = 18$ sec

$s = 56$ cm

Find

(a) ω

(b) v

$s = r\omega t$

$56 = 12.96 \cdot 18 \cdot \omega$

$\omega = \frac{56}{12.96 \cdot 18} \approx$ 0.24 rad/sec

(b) $v = r\omega$

$v = 12.96 \cdot 0.24$

$v = 3.11$ cm/sec

(40) Given

Large

$r = 15$cm

$\theta = 2\pi \cdot 25 = 50\pi$

$t = 36$

Small

$r = 8$cm

$s = 2356$

$t = 36$

Find ω

$\omega = \frac{\theta}{t}$

$\omega = \frac{50\pi}{36} \approx 4.36$ rad/sec

$s = r\theta$

$s = 15 \cdot 50\pi$

$= 750\pi$

$s \approx 2356$ cm

Find ω

$s = r\omega t$

$2356 = 8 \cdot 36 \cdot \omega$

$\omega = 8.18$ rad/sec

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Given

$r = 13$ in

$\theta = 2\pi \cdot 200$

$t = 1$ min

Find

V in mph

$$V = \frac{r\theta}{t}$$

$$V = \frac{13 \cdot 2\pi \cdot 200}{1}$$

$$V = 5200\pi \text{ in/min}$$

$$5200\pi \frac{\text{in}}{\text{min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{1 \text{ mi}}{5280 \text{ ft}}$$

$$\approx 15.47 \text{ mph}$$

(43)

$\theta = 2\pi \cdot 5000$

$t = 60$ sec.

$w = \frac{10000\pi}{60} \approx 523.6$ rad/sec.

$= \frac{500\pi}{3}$

Test

- convert between radians/degrees
- Arc length $s = r\theta$
- Linear/Angular velocity

$v = \frac{s}{t}$ $v = \frac{r\theta}{t}$ $v = r\omega$ $\omega = \frac{\theta}{t}$ $s = r\omega t$

- Application Problems
- Recreate unit circle, Angles + coord.
- Speed test

Sect. Review

#5, 7, 11, 13, 19, 21, 47, 59-65